

WHAT IS CLAIMED IS:

1. A negative electrode for a non-aqueous secondary battery comprising  
an intermetallic compound capable of occluding/desorbing lithium as  
5 an active material layer on a collector,  
wherein the intermetallic compound contains at least one kind of  
element A selected from Sn, In, Ge, Ga, Pb, Al, Sb, and Si, and an element X  
that does not substantially react with Li, and  
in X-ray diffraction measurement with a  $\text{CuK}\alpha$ -ray of the active  
10 material layer, assuming that highest peak intensities of diffraction lines  
derived from the intermetallic compound and the element A are  $I_a$  and  $I_b$ ,  
respectively, an intensity ratio  $I_b/I_a$  is 0.1 or less.
2. A negative electrode for a non-aqueous secondary battery comprising  
15 an intermetallic compound capable of occluding/desorbing lithium as  
an active material layer on a collector,  
wherein the intermetallic compound contains  
at least one kind of element A selected from Sn, In, Ge, Ga, Pb,  
Al, Sb, and Si, and an element X that does not substantially react with Li,  
20 and  
a protective layer for preventing a reaction between the active  
material layer and the collector is provided therebetween.
3. The negative electrode for a non-aqueous secondary battery according to  
25 claim 2, wherein, in X-ray diffraction measurement with a  $\text{CuK}\alpha$ -ray of the  
active material layer, assuming that highest peak intensities of diffraction  
lines derived from the intermetallic compound and the element A are  $I_a$  and  $I_b$ ,  
respectively, an intensity ratio  $I_b/I_a$  is 0.1 or less.
- 30 4. The negative electrode for a non-aqueous secondary battery according to  
claim 2, wherein a main constituent element of the protective layer is  
different from that of the intermetallic compound.
- 35 5. The negative electrode for a non-aqueous secondary battery according to  
claim 4, wherein the main constituent element of the protective layer is at  
least one kind of element selected from Ti, Ni, Zr, W, and Ag.

6. The negative electrode for a non-aqueous secondary battery according to claim 2, wherein a thickness of the protective layer is 0.05 to 0.5  $\mu\text{m}$ .
- 5 7. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein the element X is at least one kind of element selected from Cu, Ni, Fe, Mn, Co, Cr, Mo, W, Ti, and Zr.
- 10 8. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein the element X is at least one kind of element selected from Cu, Ni, and Fe.
9. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein the intermetallic compound is a NiAs type intermetallic compound belonging to a space group  $P6_3/mmc$ .
- 15 10. The negative electrode for a non-aqueous secondary battery according to claim 9, wherein the NiAs type intermetallic compound is  $\text{Cu}_6\text{Sn}_5$ .
- 20 11. The negative electrode for a non-aqueous secondary battery according to claim 1 or 3, wherein, assuming that a highest peak intensity of a diffraction line derived from an intermetallic compound phase other than the intermetallic compound capable of occluding/desorbing lithium is  $I_c$ , an intensity ratio  $I_c/I_a$  is 0.05 or less.
- 25 12. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein a thickness of the active material layer is 20  $\mu\text{m}$  or less.
- 30 13. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein a thickness of the active material layer is 10  $\mu\text{m}$  or less.
14. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein the collector is composed of at least one kind of element selected from Cu, Ni, Fe, and Ti, and an alloy thereof.
- 35 15. The negative electrode for a non-aqueous secondary battery according to claim 1 or 2, wherein the active material layer contains at least one kind of

metal element having a melting point of 700°C or lower, in addition to the element A.

- 5 16. A negative electrode for a non-aqueous secondary battery comprising an active material layer substantially composed of a single phase of an intermetallic compound capable of occluding/desorbing lithium, the active material layer being formed by alternately laminating, on a collector, a thin film with a thickness of 10  $\mu\text{m}$  or less containing at least one kind of element A selected from Sn, In, Ge, Ga, Pb, Al, Sb, and Si and a thin film containing at least one kind of element X selected from Cu, Ni, Fe, Mn, Co, Cr, Mo, W, Ti, and Zr, thereby forming a laminated film, and heat-treating the laminated film.
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- 15 17. The negative electrode for a non-aqueous secondary battery according to claim 16, wherein a protective layer for preventing a reaction between the collector and the active material layer is provided therebetween.
- 20 18. The negative electrode for a non-aqueous secondary battery according to claim 16, wherein the active material layer contains at least one kind of metal element having a melting point of 700°C or lower, in addition to the element A.
- 25 19. A non-aqueous secondary battery comprising a negative electrode comprising an intermetallic compound capable of occluding/desorbing lithium as an active material layer on a collector, a positive electrode, and a non-aqueous electrolyte, wherein the intermetallic compound contains at least one kind of element A selected from Sn, In, Ge, Ga, Pb, Al, Sb, and Si, and an element X that does not substantially react with Li, and in X-ray diffraction measurement with a  $\text{CuK}\alpha$ -ray of the active material layer, assuming that highest peak intensities of diffraction lines derived from the intermetallic compound and the element A are  $I_a$  and  $I_b$ , respectively, an intensity ratio  $I_b/I_a$  is 0.1 or less.
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20. A non-aqueous secondary battery comprising  
a negative electrode comprising  
an intermetallic compound capable of occluding/desorbing  
lithium as an active material layer on a collector,  
5 a positive electrode, and  
a non-aqueous electrolyte,  
wherein the intermetallic compound contains at least one kind of  
element A selected from Sn, In, Ge, Ga, Pb, Al, Sb, and Si, and an element X  
that does not substantially react with Li, and  
10 a protective layer for preventing a reaction between the active  
material layer and the collector is provided therebetween.
21. The non-aqueous secondary battery according to claim 20, wherein, in  
X-ray diffraction measurement with a CuK $\alpha$ -ray of the active material layer,  
15 assuming that highest peak intensities of diffraction lines derived from the  
intermetallic compound and the element A are  $I_a$  and  $I_b$ , respectively, an  
intensity ratio  $I_b/I_a$  is 0.1 or less.
22. The non-aqueous secondary battery according to claim 20, wherein a  
20 main constituent element of the protective layer is different from that of the  
intermetallic compound.
23. The non-aqueous secondary battery according to claim 22, wherein the  
main constituent element of the protective layer is at least one kind of  
25 element selected from Ti, Ni, Zr, W, and Ag.
24. The non-aqueous secondary battery according to claim 20, wherein a  
thickness of the protective layer is 0.05 to 0.5  $\mu\text{m}$ .
- 30 25. The non-aqueous secondary battery according to claim 19 or 20, wherein  
the element X is at least one kind of element selected from Cu, Ni, Fe, Mn, Co,  
Cr, Mo, W, Ti, and Zr.
26. The non-aqueous secondary battery according to claim 19 or 20, wherein  
35 the element X is at least one kind of element selected from Cu, Ni, and Fe.
27. The non-aqueous secondary battery according to claim 19 or 20, wherein

the intermetallic compound is a NiAs type intermetallic compound belonging to a space group  $P6_3/mmc$ .

28. The non-aqueous secondary battery according to claim 27, wherein the  
5 NiAs type intermetallic compound is  $Cu_6Sn_5$ .

29. The non-aqueous secondary battery according to claim 19 or 21, wherein,  
assuming that a highest peak intensity of a diffraction line derived from an  
intermetallic compound phase other than the intermetallic compound capable  
10 of occluding/desorbing lithium is  $I_c$ , an intensity ratio  $I_c/I_a$  is 0.05 or less.

30. The non-aqueous secondary battery according to claim 19 or 20, wherein  
a thickness of the active material layer is 20  $\mu m$  or less.

15 31. The non-aqueous secondary battery according to claim 19 or 20, wherein  
a thickness of the active material layer is 10  $\mu m$  or less.

32. The non-aqueous secondary battery according to claim 19 or 20, wherein  
the collector is composed of at least one kind of element selected from Cu, Ni,  
20 Fe, and Ti, and an alloy thereof.